

WHAT IS CLAIMED IS:

1. A proton conductive membrane comprising:
layered clay mineral powder which is a cation exchanger or an anion
exchanger; and
5 a first crosslinking structure including an -O-SO₂-O- group which
crosslinks particles of the layered clay mineral powder.
2. The proton conductive membrane according to claim 1, wherein
particles of the layered clay mineral powder have an acid site on a surface thereof, and
10 the layered clay mineral powder in the proton conductive membrane has been applied
by a modifying agent which contains one or more compounds selected from the group
consisting of sulfuric acid and metal sulfates.
3. The proton conductive membrane according to claim 1, wherein a
15 sulfo group exists on a surface of the particle of the layered clay mineral powder.
4. The proton conductive membrane according to claim 1, wherein the
layered clay mineral powder is the anion exchanger, a strong acid has been inserted
between layers of the particle of the layered clay mineral powder.
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5. The proton conductive membrane according to claim 4, wherein the
strong acid is tungstosilicic acid.
6. The proton conductive membrane according to claim 4, wherein the
25 proton conductive membrane comprises a second crosslinking structure obtained by
crosslinking the particles of the layered clay mineral powder using at least one of
phosphoric acid and a compound containing a phosphate group.
7. A production method of a proton conductive membrane, comprising:
30 a preparing step of a preparing a spreading solution including layered
clay mineral powder which is a cation exchanger or an anion exchanger and a
modifying agent which contains one or more compounds selected from the group
consisting of sulfuric acid and metal sulfates;

a spreading step of spreading the spreading solution on a substrate such that a liquid membrane is formed; and

a removing step of removing a solvent from the liquid membrane by drying.

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8. The production method according to claim 7, wherein the preparing step includes a step of dispersing the layered clay mineral powder in the solvent such that a solution is obtained, and then adjusting pH of the solution to a predetermined pH, and a step of adding the modifying agent to the solution.

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9. The production method according to claim 7, wherein the production method includes an inserting step of inserting a strong acid between layers of the particle of the layered clay mineral powder by immersing the layered clay mineral powder in a strong acid solution before the preparing step.

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10. The production method according to claim 9, wherein the strong acid is tungstosilicic acid.

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11. The production method according to claim 9, wherein the strong acid solution is a nonaqueous solvent solution of the strong acid.

12. The production method according to claim 9, wherein the modifying agent contains at least one of phosphoric acid and a compound containing a phosphate group.

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13. The production method according to claim 7, wherein an acid site which reacts with at least one of the sulfuric acid and the metal sulfate exists on a surface of the particle of the layered clay mineral powder, the spreading liquid is obtained by mixing the at least one of the sulfuric acid and the metal sulfate and the layered clay mineral powder so that a sulfo group is introduced to the surface of the particle of the layered clay mineral powder in the preparing step, and amount of the at least one of the sulfuric acid and the metal sulfate is excessive as compared with the number of the acid sites of the particles of the layered clay mineral powder.

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